

REMARKS

Claim 30 is rejected under 35 USC 112, second paragraph for lack of antecedent basis for the limitation “said thin film electrical heating element.” Applicant has amended claim 30 to address this issue, which is believed to now be moot.

Claims 30-31, 34-37, 41 and 50 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al in view of Maeda et al. Claim 32 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda and Belitski. Claim 33 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda and Cooper. Claims 38-40 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda and Sano et al. Claim 45 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda, Flory and Brown. Claims 43-44 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda and Flory. Claims 42 and 46-48 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda, Flory, Brown and Aslam et al. Claim 49 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Auding et al. in view of Maeda, Flory and Peterson. Applicant respectfully disagrees with the Examiner’s analysis and respectfully asserts that these prior art references fail to teach or suggest all of the elements and limitations of the claims.

More specifically, the claims of the present invention are directed to a thin film electrical heating element (and methods of manufacturing same) that includes an **electrically conductive layer substantially comprising a metal oxide doped with two or more rare earth elements in substantially equal quantities**. The thin film electrical heating element is capable of operating at 650°C or at power densities above 10 W/cm². The present invention addresses problems in prior art thin film electrical heating elements that arise because such prior art devices become unstable under these conditions due to a tendency of the metal oxide film to change state. This state change can become permanent when fluorine is present as an electron donor. Another problem is that stannic chloride used in spray pyrolysis becomes unstable in high humidity.

The Examiner acknowledges that Auding et al fails to teach or suggest a metal oxide layer being doped with two or more rare earth elements in substantially equal quantities, but goes to assert that Maeda teaches these limitations. The Examiner's analysis is flawed and fails to establish a *prima facie* case of obviousness. More particularly, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art references must teach or suggest all of the claim limitations. Second, there must be some reasonable expectation of success. Third, there must be some suggestion or motivation to combine the reference teachings. See MPEP 2143. The Examiner's analysis fails all three criteria.

With respect to the first criteria, the Maeda reference fails to teach or suggest important features of the claims. More particularly, the claims of the present invention

recite an **electrically conductive layer substantially comprising a metal oxide doped with two or more rare earth elements in substantially equal quantities**. Maeda describes a sintered ceramic body of silicon nitride and an inorganic conductor embedded in the sintered body. The electrically-insulating/non-conducting ceramic body has 8% to 19% by weight of a single rare earth element together with other oxides. In Maeda, a single rare earth element (not two rare earth elements in substantially equal quantities) is used to dope an electrically-insulating non-conductive silicon nitride matrix (not an electrically conducting layer comprising metal oxide). Thus, Maeda fails to teach or suggest the use of rare earth elements in a thin film electrically conductive layer as recited in the claims. Maeda also fails to teach or suggest the use of rare earth elements in equal quantities in a thin film electrically-conductive layer as recited in the claims. Finally, Maeda fails to teach or suggest the use of rare earth elements to stabilize a thin film electrically-conductive layer for high temperature and/or high power applications as recited in the claims.

With respect to the second criteria, there can no reasonable expectation of success with the use of the teaching of the Auding et al. reference. More particularly, the Auding et al reference describes a thin film heating element formed by spray pyrolysis of stannic chloride. The thin film heating element is realized from a thin metal oxide film with compensating donor and acceptor dopants. Examples of the donor dopants are antimony and flourine, while examples of the acceptor dopants are indium, boron, zinc and aluminum. Auding et al. is silent as to the use of rare earth elements for stabilization. Moreover, Applicants discovered that such films are difficult to deposit in humid

environments and are unstable in high power applications. Given that the Auding et al reference teaches thin film heating elements with problems which the present invention seeks to overcome, Auding et al. can hardly be seen to provide a combination with a reasonable expectation of success.

With respect to the third criteria, the Examiner has failed to show a teaching or suggestion to combine the Auding et al. reference with the Maeda reference.

Because the Examiner's analysis does not satisfy any one of the three criteria, the Examiner has failed to establish a prima facie case of obviousness of the claims. Applicant respectfully requests that the Examiner provide such a prima facie rejection or otherwise allow the claim.

The dependent claims 31-42 and 44-49 are patentable over the cited prior art for those reasons advanced above and for reciting additional features that are neither taught nor suggested in the prior art.

For example, claim 49 is directed to method of manufacture of a thin film heating element wherein the metal oxide is deposited on the substrate in "substantially anhydrous conditions." The Examiner applies the Peterson reference. However, the Peterson reference discloses a process of hydrolysis of a metal by using absorbed moisture to provide the water for hydrolysing metal halides into metal oxides. A hydrolysis process

is a process which inherently requires water. See col. 1, lines 11-44 of Peterson. In contrast, claim 49 is directed to “anhydrous conditions” which inherently lack water.

In another example, claims 38-40 recite specific mol percentages of rare earth elements. The Examiner applies the Sano reference. However, the Sano reference teaches the use of rare earth elements to shift the Curie point of a ceramic capacitor dielectric. It has nothing to do with the use of rare earth elements in a thin film heating element as recited in the present application, and thus is non-analogous art that cannot be properly used against the claims of the present invention.

In another example, claim 45 recites the use of pyrolysis of an organometallic base solution comprising “monobutyl tin chloride”. The Examiner applies the Brown reference. However, the Brown reference clearly fails to teach or suggest a thin film intended for use at the high temperatures and/or high power densities contemplated by the present invention.

In other examples, claims 42-44 are directed to specific methods steps in the manufacture of a thin film heating element. The Examiner applies the Flory and Aslam references. However, the Flory and Aslam references relate to superconductors. Superconductors are low temperature devices which are intended to have zero resistance and operate at low temperatures. In contrast, the thin film heating element of the present invention needs to have significant resistance to generate the required heating effect and

operates at elevated temperatures. Thus, the Flory and Aslam references are non-analogous art that cannot be properly used against the claims of the present invention.

In light of all of the above, it is submitted that the claims are in order for allowance, and prompt allowance is earnestly requested. Should any issues remain outstanding, the Examiner is invited to call the undersigned attorney of record so that the case may proceed expeditiously to allowance.

Respectfully submitted,



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